

CRUISE REPORT
Delaware II Large Whale Survey DE 04-11
July 26 - August 19, 2004

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OBJECTIVES AND METHODS

The 2004 Large Whale Survey DE0407 was conducted between July 26 and August 19, 2004, aboard the NOAA R/V Delaware II. The cruise was operated by the National Marine Fisheries Service's (NMFS) Northeast Fisheries Science Center (NEFSC), located in Woods Hole, Massachusetts. The principal objective of this survey was to obtain skin samples of humpback whales (*Megaptera novaeangliae*) on the southern flank of Georges Bank, the Northeast Peak, and the Scotian Shelf for genetic analyses of their population structure. In addition, any humpback whales, right whales (*Eubalaena glacialis*) or blue whales (*Balaenoptera musculus*) encountered were photographed for individual identification.

The survey area included the waters from Georges Bank to the Laurentian Channel. Survey track lines were laid out to maximize the likelihood of encountering humpbacks, and were primarily directed over areas that had relatively high encounter rates on past surveys (see cruise report for 2003). Track lines were typically surveyed at 10 knots, however, on occasion slower speeds were used in marginal sighting conditions.

Watches were conducted on the flying bridge from 06:00 to 18:00, weather permitting. Teams of three observers searched for whales, intermittently using 7x50 or 25x120 binoculars. One observer watched the trackline and served as the data recorder. Positions were rotated every 30 minutes. All marine mammal species sighted were recorded; data taken included species, number in group, position, direction of movement and behavior. In addition, sighting condition variables were recorded at the beginning of each observer rotation and when conditions changed. These variables included Beaufort sea state, visibility and glare. The ship's Scientific Computer System (SCS) automatically collected a suite of other environmental information every 15 seconds, including the ship's position, speed, heading and the sea surface temperature. The SCS data will be merged with the time stamped effort and sighting data post-cruise. All data will be archived in the NEFSC Oracle database system in Woods Hole.

When whales were sighted, the vessel broke from the survey track to obtain photographs for individual identification and biopsies. If the weather conditions allowed, one or two rigid hull inflatable boats (RHIBs) were deployed for more effective sample collection. Biopsy samples were taken using crossbows that generated a bolt velocity of 180 feet^{-sec}, however, from the ship we also used a crossbow that generated a bolt velocity of 256 feet^{-sec}. The bolts, manufactured by "Ceta-Dart", had hollow stainless steel tips with tines inside to retain samples. The tips themselves were 5mm in diameter and 25-40mm in length. Molded foam near the bolts' tip kept them afloat for retrieval after a shot was taken. We used a "Game Tracker" line dispensing system to retrieve bolts when sampling from the ship.

Samples were processed in the ship's wet lab at the end of each day. Each sample was cut in half, then one half placed in a vial containing DMSO, the other placed in an empty vial and frozen at -10F for archiving. The samples in DMSO will be sent to the University of California, Berkeley, for genetic analysis. The frozen samples will be kept at the NEFSC and made available for additional analyses.

Photographs were collected using 6.3 megapixel digital SLR cameras (Canon EOS D10) equipped with 100-300mm zoom lenses. A 500mm 4.5 lens was also used for taking pictures from the ship. Time stamped JPEG images were saved onto the cameras' compact flash cards and downloaded onto a desktop computer at the end of each day and inter-matched within and between days. All images will be kept in the NEFSC Protected Species Branch digital archives. Copies of all humpback whale fluke and dorsal fin images will be sent to the North Atlantic Humpback Whale Catalogue at College of the Atlantic, Bar Harbor, Maine, and to the Center for Coastal Studies in Provincetown, Massachusetts.

RESULTS

A total of 104 survey hours were logged over 17 days of effort, and an additional 55 hours were spent collecting biopsies and photographs for individual identification. A total of 46 successful biopsies were obtained, including samples from 43 humpback whales, one right whale and two pilot whales. A total of 56 individual humpback whales were photographed, as well as six right whales, one blue whale and one finback whale.

Effort and large whale sightings are summarized in Table 1. Figure 1 plots the ship's track during marine mammal survey effort. Figure 2 shows locations of photographed or biopsied humpback whales. Figures 3-6 show locations of other cetacean species recorded during survey effort. The Appendix contains an account of the cruise's daily activities.

ACKNOWLEDGMENTS

We thank the captain and crew of the NOAA R/V Delaware II for all their help with this work. We are also grateful to the scientists and observers who participated in this summer's large whale survey: Tim Cole, Peter Duley, Brendan Hurley, Misty Nelson, John Nicolas, Misty Niemeyer, Richard Pace, Brenda Rone and Erika Zollett. Jooke Robbins of the Center for Coastal Studies provided a catalogue of biopsied Gulf of Maine humpbacks and advice on where to go. We are also grateful to Jerry Conway and Rob Stephenson of the DFO for their continued assistance and cooperation regarding marine mammal research on the Scotian Shelf.

Table 1. Summary for the DE0407 Large Whale Survey, July 26 - August 19, 2004. "Effort" separates the number of hours on survey (S) and hours collecting photos/samples (P) for each day. "Area Surveyed" lists approximate daily start and end positions, however, track lines often had acute course changes and paralleled 100-fathom contours. "SS" is the Beaufort sea state and "Viz" is the visibility in nautical miles (7 = crisp horizon). "Sightings" gives both the tally of the total number of individuals seen as well as the number of sightings in parentheses--no parentheses indicates only singletons seen. Species codes include: Mn = humpback whale; Eg = right whale; Bm = blue whale; Bp = fin whale; Bb = sei whale; fs = fin/sei whale. The "ID" column tallies the number of individuals photographed and accounts for duplicates from previous days separately. "Biopsy" is the number of individuals from whom skin samples were successfully collected.

Date	Effort	Area Surveyed	SS	Viz	Sightings	IDs	Biopsy
July 26		Depart Woods Hole			--		
27	S 11 P 1	Southwest & Southeast Parts of Georges Bank (4034N 6800W to 4100N 6630W)	1-2	2-7	Bp 11 (6) fs 3 (2)		
28	S 10 P 2	Northeast Peak & Northeast Channel (4110N 6625W to 4230N 6450W)	2-4	0-4	Eg 7 (4) Bp 1 fs 1	Eg 3	
29	S 5 P 1	Western Gully & Western Bank (4300N 6320W to 4335N 6141W)	2-3	1-2	Mn 1	Mn 1	
July 30 – August 2		Woods Hole (generator repair)			--		
3	S 3	Northeast Peak (4211N 6716W to 4211N 6616W)	1-2	0-2	Eg 1 Bb 1		
4		Fogged in on Browns Bank		0	--		

Date	Effort	Area Surveyed	SS	Viz	Sightings	IDs	Biopsy
5	S 9 P 1	Browns Bank (4212N 6515W to 4252N 6615W)	1-2	3-5	Eg 8 (4) Bp 2 Bb 1	Eg 2	
6		Bar Harbor (crew change)			--		
7	S 10 P 2	Roseway Basin & Lehave Basin (4313N 6525W to 4400N 6320W)	3-4	5-7	Mn 1 Eg 1 Bp 9 (7) fs 1	Mn 1 Eg 1	Mn 1 Eg 1
8	S 8 P 5	Canso Bank (4500N 6100W to 4510N 5847W)	3-5	6-7	Mn 4 (2)	Mn 3	Mn 1
9	S 2 P 9	Stone Fence (4430N 5710W to 4445N 5717W)	2	7	Mn 20 (13)	Mn 12	Mn 6
10	S 2 P 9	Stone Fence (4446N 5719W to 4507N 5738W)	3-4	6-7	Mn 17 (5)	Mn 7 +7 dup	Mn 6
11	S 2 P 8	Stone Fence & Artimon Bank (4504N 5738W to 4513N 5750W)	2-5	5-7	Mn 17 (13)	Mn 6 +1 dup	Mn 12
12	S 2 P 8	Banquereau (northwest part) (4440N 5856W to 4440N 5940W)	1-2	7	Mn 18 (10) Bp 6 (3)	Mn 16 Bp 1	Mn 15
13	S 8 P 2	Middle & French Bank (4421N 6016W to 4500N 6100W)	2-5	4-7	Mn 1 Bm 1 Bp 2	Mn 1 Bm 1	
14	S 7	The Slipper & The Patch (4340N 6203W to 4418N 6216W)	4-6	1-7	Bp 4		
15	S 11	Emerald Basin to Roseway Bank (4349N 6305W to 4325N 6458W)	1-4	5-7	Bp 5 (3) Bb 1		
16	S 2 P 3	Northeast Peak (4207N 6620W to 4207W 6636W)	2	0-3	Mn 3 Bb 1	Mn 2	
17	S 6	Northeast Peak & Georges Bank (4203N 6657W to 4140N 6705W)	2-5	7	--		
18	S 6 P 4	Northeast Peak & Northern Edge (4203N 6607W to 4206N 6732W)			Mn 8 (5)	Mn 7	Mn 2
19		Arrive Woods Hole					
Totals	S 104 P 55				Mn 90 (54) Eg 17 (10) Bm 1 Bp 40 (19) Bb 4 fs 5 (4)	Mn 56 Eg 6 Bm 1 Bp 1	Mn 43 Eg 1

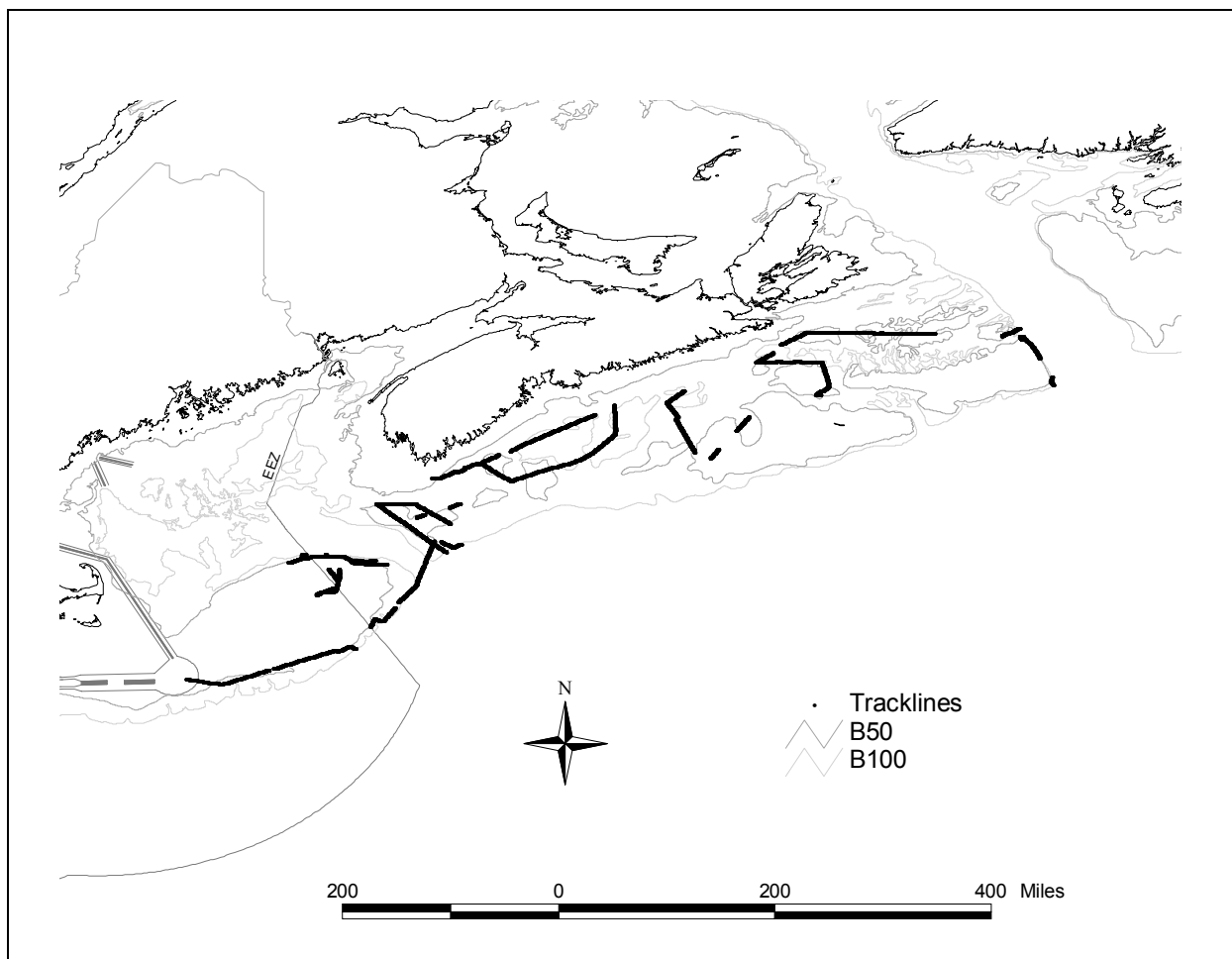


Figure 1. DE0411 Survey Tracklines.

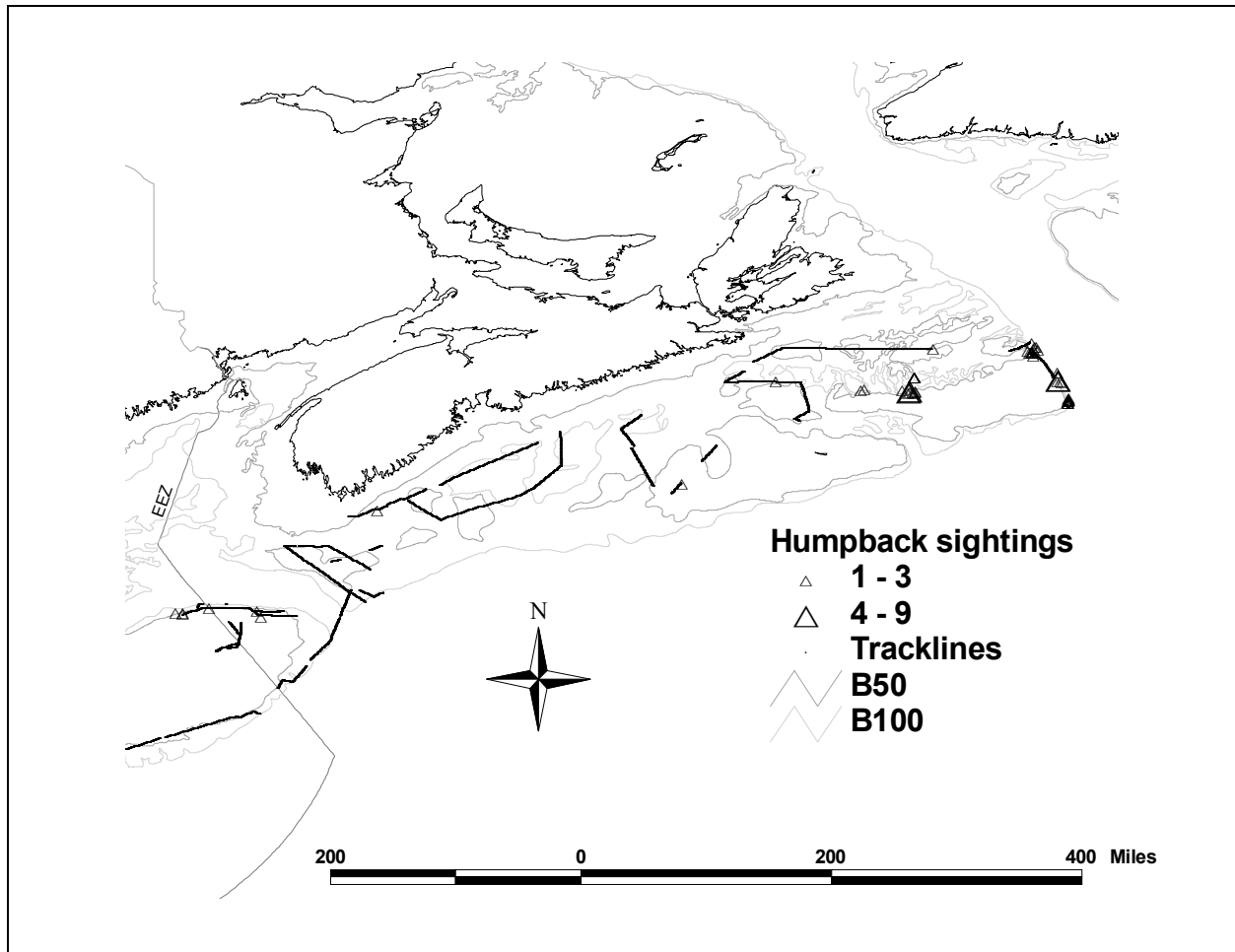


Figure 2. Positions of photographed or biopsied humpback whales.

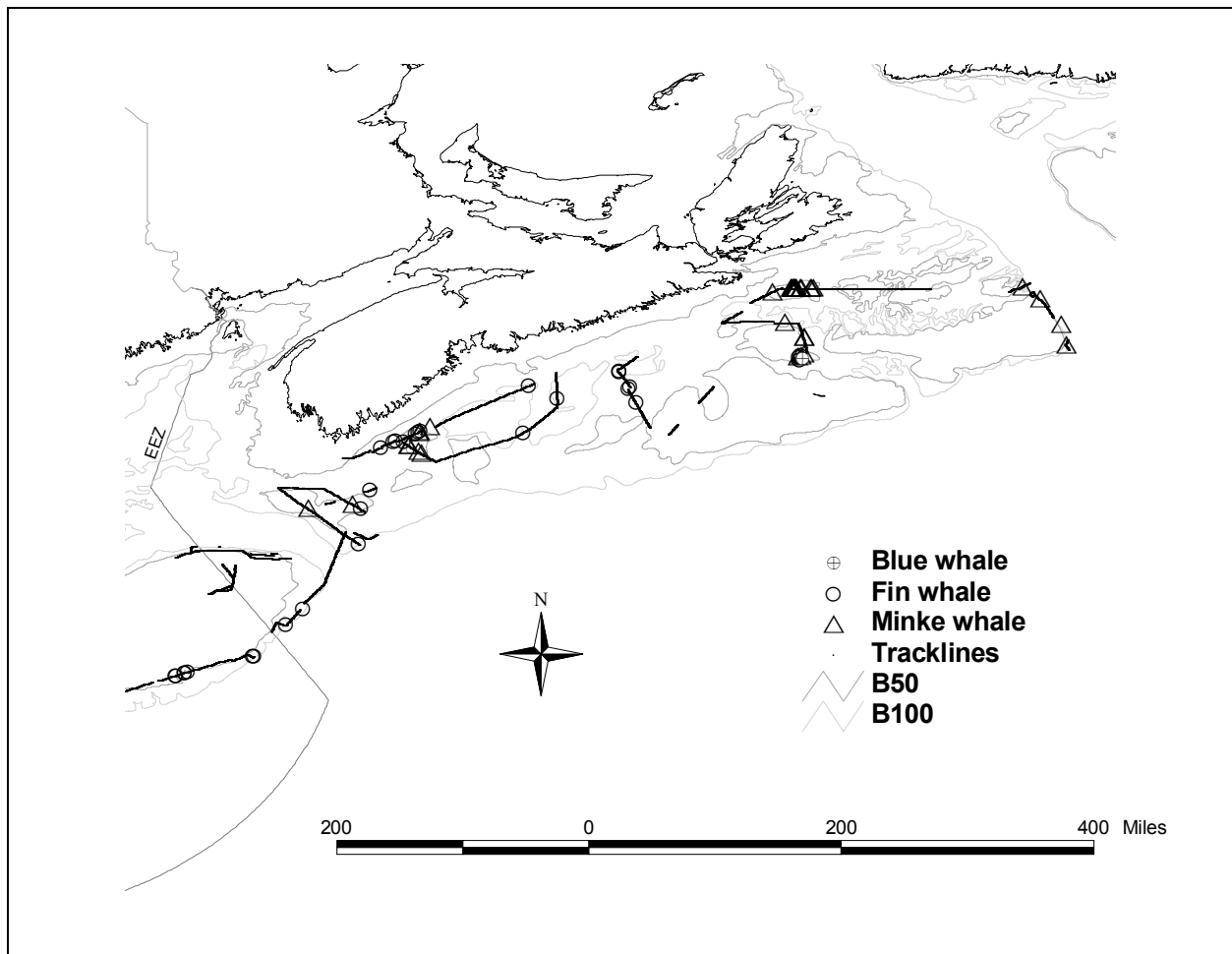


Figure 3. Locations of blue, fin and minke whale sightings.

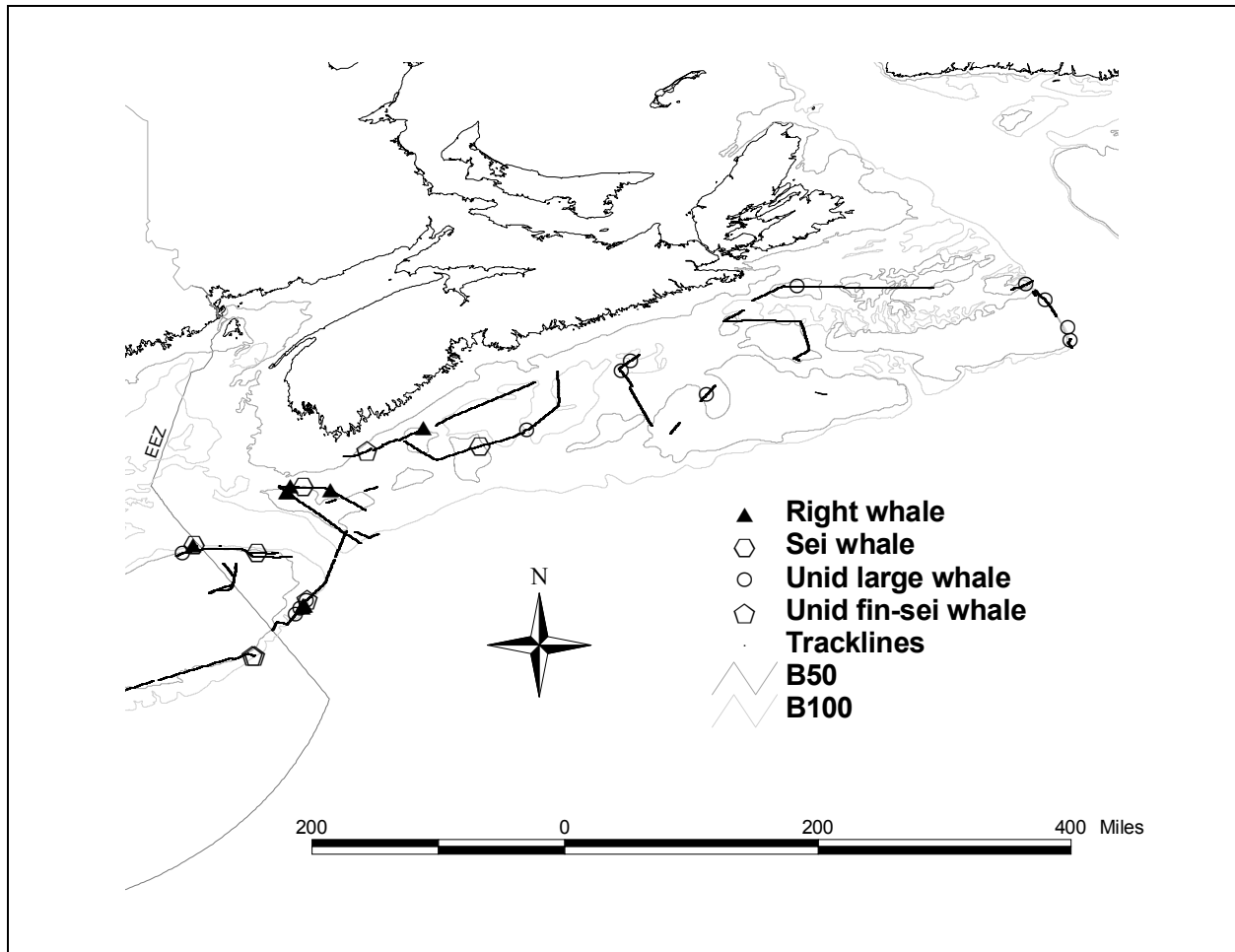


Figure 4. Locations of right whale, sei whale, unidentified large whale, and unidentified fin or sei whale sightings.

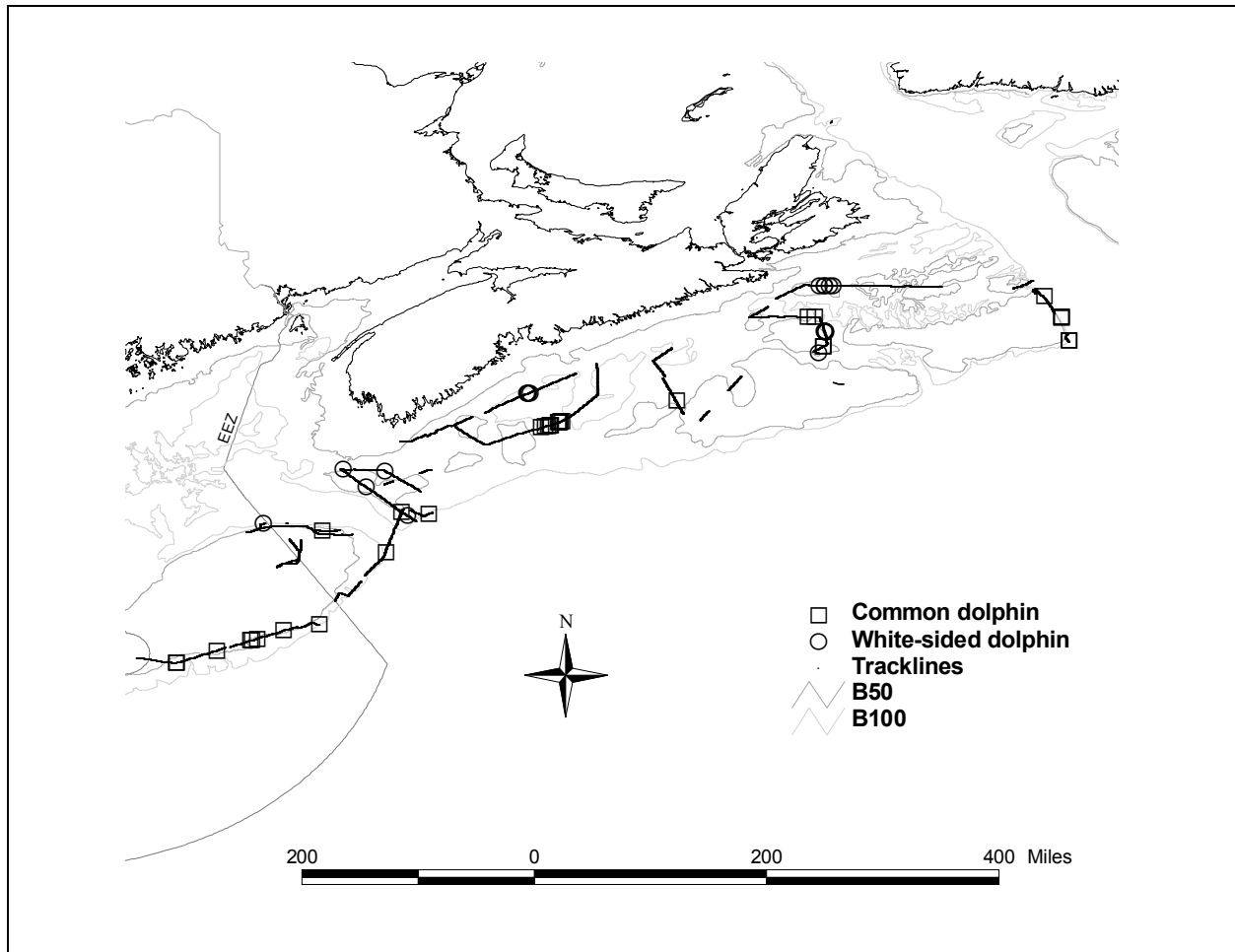


Figure 5. Locations of common and Atlantic white-sided dolphin sightings.

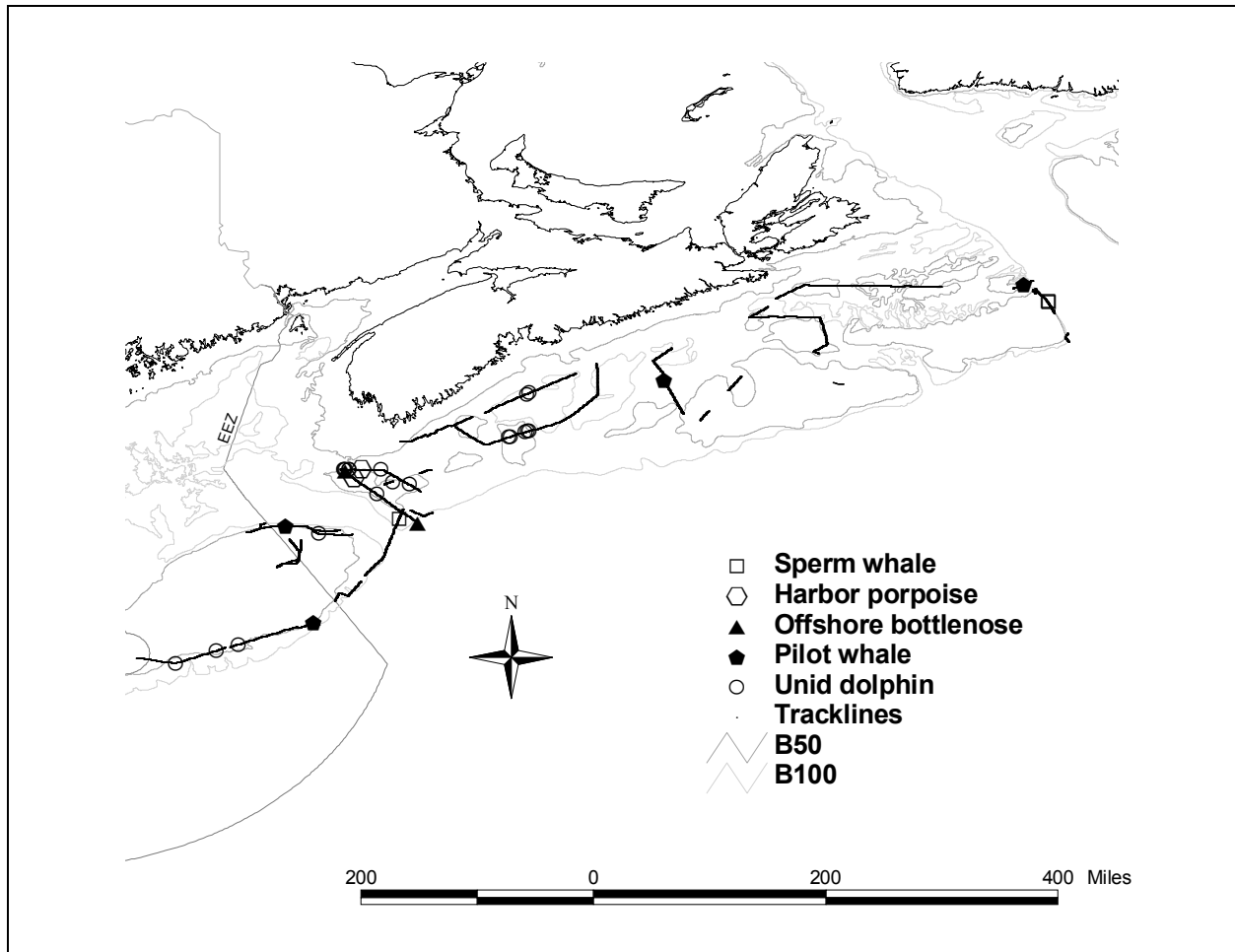


Figure 6. Locations of sperm whale, harbor porpoise, offshore bottlenose dolphin, pilot whale, and unidentified dolphin sightings.

APPENDIX

July 26: Departed Woods Hole 1700.

July 27: Ran along 50f contour S of Georges (4030N 6820W to 4100N 6630W) with 6+nm vis and Beaufort 1-2. Saw a few fin whales, c'est tout.

July 28: Crossed the Hague Line and headed up to the Northeast Peak (4110N 6620W to 4150N 6545W) with ~2nm vis and Beaufort 4. No humpbacks, but 6 right whales at ~4340N 6340W. Crossed NE Channel headed to E edge of Browns Bank, but ran into fog once across the Channel.

July 29: Continued steaming E overnight and arrived at the box canyon S of Western Gully, then headed NE across Western Bank in fog. The fog cleared for a couple hours and allowed us to spot the first humpback of the trip at 4334N 6140W. Got a full set of photos but couldn't close w/ the ship for biopsy. Fog came back in and we left the whale. Began heading NE in hopes of getting ahead of the fog again, but generator problems on the ship forced us to turn back to Woods Hole.

July 30: Heading steadily SW towards Great Round Shoals. Had a couple gaps in the fog coinciding with our crossing part of Roseway and the 50f on the east side of Browns Bank. The team posted to the flying bridge saw a

fin whale and a leatherback turtle on Roseway, but nothing on Browns (b/w 4243N 6540W and 4239N 6550W). Fog closed in pretty much for good thereafter. Will arrive in Woods Hole @ 1200 tomorrow.

August 2: Generator fixed. Left the dock at 1400 and currently heading to the Northern Edge of Georges. Will verify report of humpbacks on the Hague Line there. May not be able to launch small boats if 'Alex' generates a healthy swell. If such is the case, we'll try for biopsies with the D2.

August 3: Finds us near the 100f and Hague Line on the Northern Edge. Fog cleared briefly and we got about an hour of effort in. Saw a right and sei whale at 4212N 6714W. Fog came back in before we could get id shots on the right. Heading E slowly along the 100f in hopes of finding another clearing. The reported aggregation here might have been seis and rights, but we'll try coming through the area again on our return trip.

August 5: Had a few brief openings in the fog yesterday as we tacked across Browns Bank, but each time we reached the flying bridge things closed in again. Last night Alex's swell denied most everyone a good night's sleep. Clear skies this morning with a cool N 10k wind is giving us our first good day in Canadian waters as we survey around Browns with good visibility and Beaufort 2-3. Found two right whales on top of the NW part of Browns (4250N 6611W), but biopsy attempt aborted due to scollop vessel (the only other vessel out here) hauling gear right in the whale's (and our) path. Saw a third right whale at 4253N 6608W and a group of 6 right whales at 4251N 6542W. Also had a group of 60 offshore Tursiops, a minke and some lags. No humpbacks.

August 7: Pulled into Bar Harbor yesterday for a crew change, then headed around Cape Sable NS overnight. This morning we obtained our first humpback sample on the NW corner of Roseway Basin (4317W 6512W). Only one whale to be had there, though. Photoed and biopsied a right whale at 4335N 6429W. The whale was continuous w/ no lips or post blowholes and had a line mark on the right side 2/3 back from the head. Also missing a small portion of its right fluke tip. The whale had heavy orange cymid load around mouth, but did not look emaciated. Minkes and fins seen intermittently throughout the day. Overall conditions were good to fair with viz to the horizon and a Beaufort around 2 early, but rising to a 4 by the end of the day. A couple Cory's shearwaters and a white-tailed tropicbird attested to Alex's passing.

August 8: Continued steaming ENE overnight and awoke a little E of Canso Bank (4500N 6100W). Turned due E and crossed Canso along the 4510N line, which was loaded with mackerelphages (minkes and white-sides) on the E half. Came across 3 humpbacks at 4510N 5845W (Misaine Bank) and spent the rest of the afternoon trying to get samples in Beaufort 5 chop with an occasional sets of ten foot swell underneath. The crew did well on approaches, but we only converted one for a sample. Lost another sample to a broken tether; did get lots of fluke and dorsal fin images, though. A fourth Mn in the area eluded us. We're heading to the south end of the Stone Fence tonight. Sounds like decent weather for a couple days.

August 9: Began the day at the southern end of the Stone Fence and quickly found 8 dispersed humpbacks at 4433N 5713W; photoed maybe 6 well and biopsied 4 with the small zodiac seeing action for the first time. Also had ~50 Tursiops in the area. In afternoon we moved NNW and found 15 humpbacks at 4445N 5717W. Got photos of at least 7, along with 2 biopsies. Swell sets still near 8 feet made ops difficult. We'll return to the 15 humps again tomorrow with (we hope) a diminished swell before continuing N toward Artimon Bank.

August 10: Returned to where we left off yesterday (4446N 5719W), relocated the same large group from last night and got 5 biopsies, plus about 5 new fluke photos from a couple new group members and some other nearbys. Some dazed krill seen at the surface. In the early afternoon, we moved north along the Stone Fence to 4451N 5722W and came upon another 6-8 dispersed whales. Worked a pair for over an hour before finally getting one sample. The swell was down but the wind was up so all work done from the bow of the D2--cumbersome despite the officers' excellent ship handling. Singletons next to impossible to get, so we opted to continue N along 100f in search of a large group. Came across more whales late in the afternoon near 4507N 5738W. Worked a trio for over an hour, but only got fluke photos. Staying here tonight--probably a dozen or so whales in the area. Tomorrow we should be able to launch the small boats and be a bit more effective. Eyeing the SW part of Misaine Bank (@4435N 5900W) for the following day.

August 11: Started the day at 4504N 5738W and launched both the small boats a little south of a dispersed gathering of maybe 20 humpbacks. Ended small boat ops 6 hours later, 9 miles N and 12 biopsies richer. A couple

miles after loading the small boats for the transit SW--directly into a 4+ Beaufort--we came across maybe another 8 very dispersed singletons along the 50f of the SE corner of Artimon Bank. We pushed on in hopes of finding a larger and more D2 friendly group, but alas, it was in vain. Now heading to 4440N 5856W and the convoluted area N of Banquereau, a.k.a., the Banks of Insanity.

August 12: Our starting waypoint for the day (4440N 5856W; @35nm due N of The Gully) also marked an aggregation of 20+ humpbacks and a half dozen fin whales. We launched the gray zodiac and collected 8 biopsies before lunch, plus another 4 before moving W along the 4440N line. Unfortunately only encountered another 3 singletons (at 4440N and 5908, 5937 and 5937W), from whom we also got biopsies. Another large group of Tursiops this morning, plus several large groups of white-sideds along the 4440N line to the W. Some sei whales also seen by the flying bridge watch near our last humpback for the day. Headed to the SE corner of Middle Bank tonight (4420N 6025W) from whence we will head due E, then dogleg up the W side of Middle toward French Bank.

August 13: Early riser Pete Duley spotted a blue whale next to our starting waypoint this morning on the SE corner of Middle Bank (4421N 6016W). We got some decent pics, then tried to survey along the the Bank's S side but promptly plowed into fog. Feeling denied, we turned to the N instead and surveyed up the E side of the Bank with good conditions (Beaufort 3-4, viz 5nm), then turned W and steamed along its N edge. Saw literally thousands of common dolphins, but found only one humpback at 4447N 6036W, which we managed to photo but not biopsy. The lone humpback turned out to be our last cetacean sighting for the day as we continued W in an increasing S wind. We bisected French Bank, then cut back to put the sun and wind behind us again as we made for the Bank's NE corner. Ended the effort for the day a little early as we turned S and began our steam to The Slipper (4330N 6200W) for tomorrow's start. Forecast mixed with the NOAA weather chart showing SW winds at 30k while the Maritime report is calling for 10-15k from the S. If the later, we'll try for The Patch, otherwise we'll settle for The Owls and The Bull Pen.

August 14: Initially Environment Canada's forecast was closer to right with 15-18kn winds from the S. We covered The Slipper (@4340N 6203W) at slow speed from the wheelhouse as rain clouds passed over. Shortly thereafter it cleared from the W and the Beaufort picked up to a 6 on our port quarter. We moved back up to the flying bridge and got back up to survey speed. Despite the seas, the lighting allowed us to see blows maybe a mile off and we saw several fin whales near The Patch (@4418N 6216W). Went to slow speed again as we bisected The Patch from SW to NE. Sighted a blow to our S, but decided against putting the sea on our beam for only one whale. We ended watch early again and began transiting into the seas toward Baccaro Bank (@4255N 6445W). This evening, however, we're loitering off Halifax until hurricane Charley has passed.

August 15: Fog cleared off at 05:30 from where we sat 15nm S of Halifax. The latest hurricane advisories reported that Charley has largely dissipated, allowing us to go where we please once again. We headed for the nearest interesting bathymetric feature--the wall of the W side of Emerald Basin due S of us. Clear skies and a lightening W wind gave us great sighting conditions, but there was little life seen as we ran SW paralleling the wall's steep slope enroute toward Bacarro Bank (from 4349N 6305W to 4331N 6325W). The only significant cetacean sighting was a broad area of common dolphins on Lehave Bank (@4321N 6325W). A little past mid-afternoon and about 15 nm from Bacorro Bank, an encroaching fog bank to our S persuaded us to turn NW toward Roseway Bank. The fog continued to chase us for the next two hours. In the final moments of keeping watch, bright blows stood out against dramatic dark clouds building in from the west--the remnants of the hurricane. With cameras and crossbows at the ready, we prepared to work quickly before the fog caught us, but it turned out to be two fin whales (at 4325N 6458W).

August 16: Started the day on the NE corner of Browns Bank heading SW in fog toward the Northeast Peak of Georges Bank, then turned due E once we reached the 100f of the Peak. By 1200 the visibility improved sufficiently to post a watch, but fog patches and the ship's fog horn kept us in the wheelhouse. At 1430, three humpbacks were sighted at 4207N 6636W, and we spent the next 3 hours getting photos, attempting to biopsy and dodging rain showers. One whale disappeared, but we managed to get fluke and dorsal photos of the remaining 2. Neither whale matched to anything in the CCS 'biopsied' catalogue. We're staying here tonight and hoping for fair weather tomorrow to launch the small boats.

August 17: About 03:00 the ship began to toss as stiff N winds built in ahead of the expected high pressure. Unfortunately, the winds kept up through the morning at or near Beaufort 6. At noon, we began surveying SSE across the Peak, parallel to the Hague Line and with following seas down to Beaufort 5. At 1300 we turned for Woods Hole because one of the ship's generators needed dockside attention once again. At 1500 the generator was reported fixed and we turned back around. There were no marine mammal sightings despite good conditions later in the afternoon (Beaufort 2, visibility unlimited), but we also never saw anything deeper than 35f. By 1830 we had returned to the position of last night's humpbacks, and will remain here until morning with the promise of calm, clear conditions.

August 18: Began the day at 4203N 6607W heading due E. We found a single humpback at 4203N 6609W, but pushed on for a larger group. After reaching the location of the humpbacks seen late the 16th and finding nothing, we turned NW and then E again to run along the 4209N line and between the 50f and 100f contours. Came across another singleton at 4209N 6709W who turned out to be "Key Hole". Changed course to the WSW, and at 4205N 6728W came across a singleton and a pair. The singleton was "Colt", which we discovered after we biopsied (twice). Attempts to biopsy the pair got us a sample from one of them. We began closing things down for the steam home, but spotted a trio at 4206N 6732W. We got fluke shots but opted not to biopsy since it was apparent that we were getting into Jooke's territory.

August 19: Arrived in Woods Hole 0700.